

10.0 EVALUATION OF ALTERNATIVES

The remediation alternatives described in Sections 8 and 9 are evaluated in this section. The evaluation concludes with a discussion of the overall evaluation and scoring, and identification of the recommended alternative. Tables 10-1 through 10-4 provide the key evaluation criteria for the remedial alternative selection process conducted during the FS.

10.1 Threshold Evaluation

Under MTCA, remediation alternatives must meet the following threshold requirements (WAC 173-340-360(2)(a):

- Protection of human health and the environment
- Compliance with cleanup standards
- Compliance with ARARs
- Provision for compliance monitoring

Each alternative is evaluated individually against the threshold criteria in the following sections.

10.1.1 Protection of Human Health and the Environment

As a threshold criterion, protection of human health and the environment addresses whether a remediation alternative would result in sufficiently low residual risk to human and ecological receptors after completion of the alternative, resulting in a minimum acceptable level of protection. The relative degree of protection provided by the alternatives is considered in the comparative evaluation. One measure of sufficient protectiveness is the second threshold criteria, compliance with cleanup standards (see Section 8.1.2). Evaluation of protection of human health and the environment also considers short-term risks posed by remedial action.

Alternative 1 (No Action) does not mitigate potential exposure pathways (i.e., exposed contaminated soil) and would not provide acceptable protection of human health and the environment. The fact that no significant groundwater impacts were found indicates the low risk posed by this site. The No Action alternative is not compliant with the ARARs as required by WAC 173-340-360(2).

Alternative 2 (Institutional Controls and Monitoring) would prevent direct public exposure to contaminated soil, but would not prevent worker exposure or off-site migration in surface water or airborne dust. Institutional controls prohibiting the excavation of soil are in direct conflict with City plans to construct additional facilities on the Central Portion of the Site (increase beneficial use). This alternative is therefore not considered sufficiently protective of human health and the environment and does not maximize the beneficial use of the Site. The Institutional Controls and Monitoring alternative is not compliant with the ARARs as required by WAC 173-340-360(2).

Alternative 3 (Capping – Monitoring and Institutional Controls) would prevent direct exposure to any contaminated soil via the cap. The cap reduces infiltration of precipitation, which would reduce the mobility and potential for it to become impacted. In addition, the cap would prevent off-site migration in surface water or airborne dust. Therefore, this alternative is protective of human health and the environment.

Alternatives 4 (Excavation and Off-site Landfill), and 6 (Excavation and Off-site Treatment) would remove contaminated soil off-site for secure landfill disposal or treatment. This removal would prevent direct exposure to contaminated soil, and also prevent off-site migration in surface water or airborne dust. Therefore, this alternative is protective of human health and the environment. In addition, by removing the contaminants from the Site, the need for long-term monitoring would be reduced.

Alternative 5 (Excavation and On-site Treatment) would remove contaminated soil for treatment on-site. This removal and treatment would prevent direct exposure to contaminated soil, and also prevent off-site migration in surface water or airborne dust. Therefore, this alternative is protective of human health and the environment. In addition, by removing the contaminants from the Site soil, the need for long-term monitoring would be reduced.

10.1.2 Compliance with Cleanup Standards

Compliance with cleanup standards is defined by meeting the requirements of WAC 173-340-700 through -760. Compliance with cleanup standards does not require removal of all waste or affected soil from a site; the regulations include provisions for meeting cleanup standards through containment. All of the alternatives except Alternative 1 (No Action) and Alternative 2 would comply with MTCA cleanup standards. Alternative 1 would have exposed contaminated soils and would not provide compliance monitoring. Alternative 2 (Institutional Controls and Monitoring) would rely on institutional controls to comply with cleanup standards, however total reliance on institutional controls is not allowed where “action” (i.e. treatment or removal) is technically feasible to implement. Alternative 3 relies on engineered containment and a conditional point of compliance at the site boundary. Alternative 4 relies on off-site containment and would comply with the Site cleanup standards specified in the CAP. Alternatives 5 and 6 rely on treatment technologies and would comply with the Site cleanup standards specified in the CAP.

10.1.3 Compliance with ARARs

Compliance with ARARs addresses whether an alternative complies with all applicable or relevant and appropriate regulations (ARARs), as defined in Section 6.

10.1.4 Provision for Compliance Monitoring

Compliance monitoring requirements are defined in WAC 173-340-410. Compliance monitoring includes: (1) “protection monitoring” to confirm that human health and the environment are adequately protected during implementation of an alternative; (2) “performance monitoring” to confirm that cleanup standards or other performance standards (e.g., cap permeability) have been attained; and (3) “confirmational monitoring” to monitor the long-term effectiveness of the remedy after completion of the alternative.

Alternative 1 (No Action) does not provide compliance monitoring, and therefore does not meet this requirement. The remaining alternatives meet this requirement by providing appropriate protection, performance, and confirmational monitoring.

10.1.5 Summary of Threshold Evaluation

Based on the foregoing evaluation, the following alternatives do not meet threshold criteria:

Alternative 1 (No Action)

Alternative 2 (Institutional Controls and Monitoring).

Alternatives 1 and 2 do not meet threshold criteria and are therefore not carried on through the alternative evaluation process. Alternatives 3, 4, 5 and 6 fulfilled the threshold requirements under WAC 173-340-360(2)(a) and are retained for further evaluation. WAC 173-340-360(2)(b) dictates that cleanup actions that fulfill the threshold criteria must also use permanent solutions to the maximum extent practicable; provide for a reasonable restoration time frame; and consider public concerns. These other requirements are given equal consideration under the MTCA hierarchy. Alternatives 3, 4, 5 and 6 are evaluated with respect to these requirements in the following sections.

10.2 Use of Permanent Solutions

WAC 173-340-360(2)(b)(i) requires that the remediation alternatives must use permanent solutions to the maximum extent practicable. WAC 173-340-360(3) describes the procedures for determining whether a cleanup action provides permanent solutions to the maximum extent practicable. A determination that a cleanup action satisfies the requirement to use permanent solutions to the maximum extent practicable is based on the same basic principles or hierarchical criteria listed in WAC 173-340-360(3)(f) for a disproportionate cost analysis. The WAC 173-340-360(3)(f) hierarchical list was presented in Section 8.1 and used in a qualitative analysis for screening remedial technologies or cleanup action components. The hierarchical list or “permanence criteria,” are further discussed below and used in a more quantitative manner to evaluate the remaining alternatives.

The following performance criteria definitions are consistent with MTCA regulations definitions presented in Section 8.1, but have been refined to minimize the overlap of considerations in the criteria. This allows decision makers to consider each criterion independently and minimizes double counting of criteria. In addition, use of independent criteria allows better comparisons between the criteria; i.e., determining the value of each criterion in terms of the other criteria. Well-defined criteria minimize misunderstandings between the concerned parties and facilitate effective communication during selection of a recommended alternative.

10.2.1 Protectiveness

Protectiveness addresses the degree to which each alternative reduces existing risk and is protective of human health and the environment, considering both on-site and off-site risks. This criterion is derived from the evaluation of the other criteria. It is not an independent criterion, but more a summary of the overall evaluation and indicative of the overall improvement of environmental quality.

10.2.2 Permanence

This criterion addresses the degree to which a remediation alternative permanently reduces the inherent toxicity, ability of contaminants to migrate in the environment, or the quantity of contaminated material including the adequacy in destroying the contaminants. This criterion also evaluates alternative against the reduction or elimination of the potential for releases of contaminants and degree of irreversibility.

10.2.3 Costs

This criterion is used to consider the costs of performing each alternative, including capital, operation and maintenance, and monitoring costs. Alternative costs are compared on a net present value basis. Known implementation difficulties with quantifiable cost impacts are included in the cost estimates.

10.2.4 Effectiveness Over the Long-Term

This criterion addresses risks remaining at the site after the remediation alternative has been implemented, and the effectiveness of the alternative at reducing risks over an extended period of time. Risks during the implementation period are addressed under short-term effectiveness. Evaluation of long-term effectiveness involves estimation of the residual risk associated with each alternative, and can be measured by the degree to which RAOs are met.

Long-term effectiveness is evaluated using the following criteria:

- The alternatives are qualitatively compared for reducing the magnitude of residual risk, including meeting RAOs. The long-term effectiveness criterion addresses both residual human health and ecological risk. However, for this site there is no need to evaluate the removal alternatives for these risks separately. Each alternative provides long-term effectiveness by eliminating pathways of exposure for human health risks in the same manner as ecological risks. Therefore, the evaluation would be the difference in the comparative analysis between the removal and non removal alternatives.
- “The degree of certainty that the alternative will be successful” as specified in WAC 173-340-360(3)(f)(iv).
- Alternatives are qualitatively evaluated for their reliability in achieving the anticipated degree of effectiveness during the period of time that hazardous substances are expected to remain on-site at concentrations that exceed cleanup levels.
- Alternatives are qualitatively evaluated for the estimated longevity of the remedy at its expected degree of effectiveness to manage treatment of residues or remaining hazardous materials.

The overall score for this criterion is obtained by giving equal weight to each of the above sub-criteria

10.2.5 Management of Short-Term Risk

This criterion addresses short-term effects on human health and the environment while the alternative is being implemented. The evaluation includes consideration of the following factors:

- Risk to site workers
- Risk to the community
- Risk to the environment (short-term ecological risk).

The primary risk to site workers would be due to construction accidents and inhalation exposure to contaminated airborne dust during grading and excavation.

The remedial action would include controls as necessary to ensure that the remedy does not create an unacceptable risk to the community or the environment. However, the risk to the site workers, community and the environment are evaluated as a whole for each remedial alternative.

10.2.6 Technical and Administrative Implementability

This criterion addresses the degree of difficulty in implementing each alternative. Implementability issues are important because they address the potential for delays, cost overruns, and failure. Known implementation difficulties with quantifiable cost impacts are included in the cost estimates. The implementability criterion focuses on less quantifiable known and potential difficulties. Implementability is evaluated considering the following per WAC 173-340-360(3)(f)(vi):

- **Technical Feasibility.** Technical feasibility addresses the potential for problems during implementation of the alternative and related uncertainties. The evaluation includes the likelihood of delays due to technical problems and the ease of modifying the alternative, if required.
- **Availability of Services and Materials.** The availability of experienced contractors and personnel, equipment, and materials needed to implement the alternative. Availability of disposal capacity is also included in the evaluation.
- **Administrative Feasibility.** The degree of difficulty anticipated due to regulatory constraints and the degree of coordination required between various agencies.
- **Scheduling.** The time required until remedial action would be complete, and any difficulties associated with scheduling.
- **Complexity and Size.** The more complex or larger a remedial action, the more difficult it is to construct or implement. In addition, the more items there are that can go wrong, the greater the chance of failure that could affect remedy effectiveness.
- **Other Considerations.** Monitoring requirements, access for construction and operation and maintenance, integration with existing operations and current or potential remedial action, and other factors were considered.

10.2.7 Community Acceptance

After the FS is finalized, an alternative is selected as the proposed remedial action. The proposed remedial action will be described in the Draft Cleanup Action Plan (DCAP) along with the remedial action selected (which may not be the remedial action recommended by the FS) and the basis for its selection. Determination of community concerns is based on public comments on the DCAP. Therefore, community acceptance is not included in the FS comparative evaluation. Instead, Ecology evaluates community acceptance after the FS is completed. The selected remedial action may be modified to address community concerns based on public comments on the FS and DCAP.

10.3 **Reasonable Restoration Time Frame**

WAC 173-340-360(2)(b)(ii) requires a remedial action to provide for a reasonable restoration time frame. WAC 173-340-360(4)(b) provides the factors to be considered to determine whether a cleanup action provides a reasonable restoration time frame. Those factors include:

- Potential risks posed by the site to human health and the environment;
- Practicability of a shorter restoration time frame;
- Current and potential future use of the site, surrounding areas and associated resources that are or may be, affecting releases for the site;

- Availability of alternative water supplies;
- Likely effectiveness of institutional controls;
- Ability to control and monitor migration of hazardous substances from the site;
- Toxicity of hazardous substances at the site; and
- Natural processes that reduce concentration of hazardous substances and have been documented to occur at the site or under similar site conditions.

Even when a cleanup action is determined to provide a reasonable restoration time frame, it does not necessarily mean that the WAC 173-360(2)(a) threshold criteria or the requirement that permanent solutions to the maximum extent possible have been met.

10.4 Comparative Evaluation Methodology

Selection of a remediation alternative is based on comparative evaluation of the alternatives (that satisfy the threshold criteria) with respect to whether they provide permanent solutions to the maximum extent practicable; provide for a reasonable restoration time frame; and consider public concerns.

The permanence criteria from WAC-173-340-360(3)(f): (1) Protectiveness, (2) Permanence, (3) Cost, (4) Effectiveness over the Long-Term (5) Management of Short-Term Risks, (6) Technical and Administrative Implementability and (7) Consideration of Public Concern are used to determine if the alternatives provide permanent solutions to the maximum extent practical. Each alternative is scored relative to the other alternatives for the permanence criteria. Because of the nature of the criteria and the uncertainties in the evaluation, the scores for these criteria are expressions of relative qualitative or semi-quantitative professional judgments. A scale of 0 (worst) to 10 (best) is used, where the best alternative with respect to the other alternatives being evaluated receives a score of 10. The worst alternative receives a score of 0. Qualitative scoring for the criteria is appropriate and is typically conducted when information to provide meaningful and defensible quantitative scoring is not available, such as is the case for this site. Each of the criteria receives equal consideration or "weight" within the evaluation of permanence of the solution.

Reasonable Restoration Time Frame is evaluated in much the same manner as the permanence of the solution. Each alternative is scored from 0 to 10 based on comparative evaluation of the alternatives with overall respect to the applicable factors listed in Section 10.3.

Consideration of Public Concern is not scored in this evaluation, as described in Section 10.2.7. Ecology evaluates community acceptance after the FS is completed, and public comment on the DCAP is registered. Consideration of Public Concerns is ensured by its incorporation in the MTCA process, under WAC 173-340-600.

These three overall requirements are considered equally under the MTCA hierarchy. Consideration of Public Concern is not evaluated by the scoring method used for the other two major criteria. Therefore, each represent 50 percent of the evaluation.

10.5 Evaluation of Remediation Alternatives for Permanence

This section provides a comparative evaluation of the alternatives using the permanence criteria (see Sections 10.2 and 10.3) and Reasonable Restoration Time Frame. All of the retained alternatives evaluated in Section 10.1 (Alternatives 3 through 6) are included in the evaluation, those that do not meet the threshold criteria are not. The basis for the scoring is provided below. The evaluation and scoring of the retained alternatives is summarized in Table 10-1.

10.5.1 Evaluation of Alternative Use of Permanent Solutions the Maximum Extent Possible

10.5.1.1 *Protectiveness*

Alternative 3 (Capping – Monitoring and Institutional Controls) reduces the on-site risk by providing a contact barrier, but does not provide any improvement in the overall environmental quality on- or off-site. For this reason, Alternative 3 is the least protective alternative and is given a score of 0.

The three remaining alternatives would present risks to remediation workers during excavation activities. Alternative 4 (Excavation and Off-Site Landfill) removes the hazardous substances and ultimately the associated environmental risk from the Site. Alternative 4 is given a score of 7. In addition to the benefits of Alternative 4, Alternatives 5 (Excavation and On-Site Treatment) and 6 (Excavation and Off-Site Treatment) destroy the hazardous substances. Therefore, Alternatives 5 and 6 are the most protective alternatives and are given scores of 10.

10.5.1.2 *Permanence*

Alternative 3 (Capping – Monitoring and Institutional Controls) provides limited reduction in the effective mobility of constituents of concern by reducing infiltration of rainwater through the contaminated soil. However, the general lack of groundwater problems indicates that the mobility of waste constituents at the Site is already low. The alternative does not allow for the destruction of the hazardous substances or permanent removal from site. Alternative 3 offers the least permanent solution and is given a score of 0.

Landfill disposal (Alternative 4) would allow the contaminated soil to be recycled and be used as cover material at the landfill. Under Alternative 4 the landfill liner would reduce the ability of the COCs to migrate. Alternative 4 is given a score of 6.

Treatment is the most effective means of permanent reduction in toxicity, mobility, and volume. The excavation and treatment alternatives (Alternatives 5 and 6) would destroy the hazardous substances and are therefore each given a score of 10.

10.5.1.3 *Cost*

The estimated costs for the alternatives are summarized in Table 10-2. The costs for remediation alternatives are estimated for budgetary and evaluation purposes; the actual cost of the remediation may vary. The cost estimates in this FS are based on the description of the alternatives and associated design assumptions in Section 7. The detailed costs for the evaluated alternatives are provided in Table 10-3. The design assumptions used here are representative and sufficient for the purposes of comparative evaluation of the alternatives, but are not necessarily the same as the design basis that would be used for the final, detailed design. Pre-design investigations would be included in the final design phase for any of these remedial actions, and the results of these investigations could result in changes from the preliminary designs presented in this FS.

The estimates were prepared to allow comparative evaluation of alternatives, not for budgeting purposes. The uncertainties in the FS designs and associated cost estimates are such that actual costs could vary significantly from these estimates. However, the uncertainty in the *relative* cost of the alternatives is much less than the uncertainty in the magnitude of the costs, and these cost estimates are suitable for comparative evaluation of the alternatives. The alternatives are given the following scores based on the costs presented in Table 10-2:

<u>Alternative</u>	<u>Score</u>
Alternative 3: Capping – Monitoring and Institutional Controls	10
Alternative 4: Excavation and Off-Site Landfill	6
Alternative 5: Excavation and On-Site Treatment	3
Alternative 6: Excavation and Off-Site Treatment	0

10.5.1.4 Effectiveness Over the Long-Term

Alternative 3 (Capping – Monitoring and Institutional Controls) would achieve the remedial action objectives. It would provide a cover over the contaminated soil, which would prevent direct contact with contaminated soils. Although groundwater is not currently impacted (with the exception of MW-11) an impermeable (asphalt) cap would decrease the possibility of migration of COCs, in the vadose zone soils by reducing or eliminating infiltrating rainwater from contacting COCs. Potential cap deterioration enhanced by large equipment and truck traffic would be countered by maintenance controls and patching over 20 years. However, the contaminated soil would remain on-site within a busy, developed area. Considering the overall effectiveness of removal to on-site containment, Alternative 3 is considered the least effective alternative over the long term and is given a score of 0.

Alternative 4 (Excavation and Off-Site Landfill) would achieve all remedial action objectives. It would remove affected soil to MTCA cleanup levels, thus preventing direct contact with contaminated soil and essentially eliminating the possibility of migration of COCs. Although, under Alternative 4 some impacted soil would remain on-site, it would be below MTCA cleanup levels. This alternative is slightly less effective than Alternatives 5 and 6 because placement of impacted soils in an off-site landfill does not completely eliminate the potential for release of contaminants. This alternative is therefore given a long term effectiveness score of 8.

Alternative 5 (Excavation and On-Site Treatment) would provide the benefits just given for Alternative 4. It would remove affected soil to MTCA cleanup levels, thus preventing direct contact with contaminated soil, and eliminate the possibility of migration of COCs. On-site treatment would generate thermally treated soil (fill) with less than desirable soil properties with respect to paving and construction projects. Under this alternative some impacted soil would remain on-site (although below MTCA cleanup levels). Alternative 5 would be effective over the long term because it includes treatment that destroys the primary (organic) COCs but not metal COCs (lead). There is a potential for treatment by thermal desorption to be incomplete or generate unacceptable air emissions. There is a greater potential for these circumstances to occur with a mobile unit than an off-site stationary unit. This alternative is therefore given a long term effectiveness score of 9.

Alternative 6 (Excavation and Off-Site Treatment) would provide the benefits just given for Alternative 4 and 5. It would remove affected soil to MTCA cleanup levels, thus preventing direct contact with contaminated soil and eliminate the possibility of migration of COCs. Under this alternative some impacted soil would remain on-site but it would be below MTCA cleanup levels. Alternative 6 would be effective over the long term because it includes treatment that destroys the primary (organic) COCs but not metal COCs (lead). There is a potential for treatment by thermal

desorption to be incomplete or generate unacceptable air emissions. However, there is less potential for these circumstances to occur with an off-site stationary unit than a mobile unit. Alternative 6 is the most effective alternative over the long term and is therefore given a score of 10.

10.5.1.5 Management of Short-Term Risk

None of the alternatives would involve significant short-term risk (i.e., during remedial action) to ecological or off-site receptors. Therefore, evaluation of short-term effectiveness focuses on relative potential risk to site workers.

For Alternative 3 (Capping – Monitoring and Institutional Controls), there would be some potential for exposure, but less than removal alternatives. On this basis, Alternative 3 (Cap) is given a score of 10.

Alternative 4 (Excavation and Off-Site Landfill) will provide the shortest exposure period of the removal alternatives, and is therefore given a score of 7.

Treatment (Alternatives 5 and 6) involves more potential for worker exposure during treatment off-site than landfill disposal, and therefore are given lower scores. Alternative 5 (Excavation and On-Site Treatment) is given the lowest score (0) as there would be more potential for public and worker exposure due to the increased length of time and the logistics of moving stockpiles on-site than there would be at the off-site treatment facility. Because Alternative 6 has a lower potential for public and worker exposure than Alternative 5, it is given a score of 6.

10.5.1.6 Implementability

Alternative 3 (Capping – Monitoring and Institutional Controls) would be the easiest to implement from a construction point of view and is given the highest score of 10. However, it would still require establishing deed restrictions and the associated stipulations for Ecology notification for cutting the cap, below grade construction activities.

Alternative 4 (Excavation and Off-Site Landfill) is the least complex of the removal alternatives, and would not be much more difficult to implement than Alternative 3 and is therefore given a score of 7.

Alternative 5 (Excavation and On-Site Treatment) is the most complex and difficult to implement. On-Site treatment involves issues regarding the availability of mobile thermal treatment units, air and noise permitting issues, stack testing and operating efficiencies. The on-site treatment alternative is therefore given the lowest score, a 0.

Alternative 6 (Excavation and Off-Site Treatment) is similar in complexity to Alternative 4, but due to volume constraints and maximum treatment capacities off-site treatment facilities do not always accept soil. The Off-Site treatment alternative is therefore given a score of 6, a slightly lower score than Off-Site disposal.

10.5.2 Evaluation of Reasonable Restoration Time Frame

The evaluation of reasonable restoration time frame was conducted from an on-site perspective with respect to the applicable factors listed in Section 10.3. Alternative 3 (Capping – Monitoring and Institutional Controls) would be the easiest to implement from a construction point of view. However, no true remediation of hazardous material would occur and compliance monitoring could continue for

20 years or more. Due to the extended period of monitoring Alternative 3 is given a 0, the lowest score.

The focal point of the excavation alternatives, which involve the removal of hazardous substances from the Site could be completed within two months from implementation of the cleanup action. However, compliance monitoring would be required as part of the threshold criteria. Alternative 4 and Alternative 6 are the off-site treatments alternatives and are given a scores of 10 and 9, respectively. Alternative 4 was rated the slight higher of the two alternatives, since soils may be held in stockpiles on site for blending purposes or due to the operating capacity of the treatment system.

Alternative 5 is given a lower score of 7, as the logistics of the on-site treatment may extend the period of performance for setup, excavation and treatment.

10.5.3 Net Benefit (Overall Non-Cost Evaluation)

The net benefit of the alternatives is determined by combining the criteria scores (see Table 10.4). The net benefit, or overall non-cost scores, is given in Table 10-1. Using these scores, the alternatives rank in the following order (most to least preferred):

1. Alternative 4 - Excavation and Off-Site Disposal.
2. Alternative 6 - Excavation and Off-Site Treatment.
3. Alternative 5 - Excavation and On-Site Treatment.
4. Alternative 3 - Capping – Monitoring and Institutional Control.

10.5.4 Cost/Benefit Analysis and Overall Evaluation

When the overall evaluation process identifies more than one alternative equally suited (based on equal evaluation scores) as the recommended alternative based on the FS, cost may be used to determine the final distinction between alternatives. The net benefit scores for the excavation and treatment alternatives (4, 5 and 6) are relatively close to one another. Due to the semi-quantitative/qualitative nature of the evaluation, the overall evaluation scores for the alternatives are considered to be subjective. As a result, a cost benefit analysis was conducted to determine if the cost of the alternative (Alternative 4) that received the most favorable score from the evaluation process had a disproportionate cost to the incremental degree of protection offered by this alternative.

Under WAC 173-340-360(3)(b) “a cleanup action shall not be considered practicable if the incremental cost of the cleanup action is substantial and disproportionate to the incremental degree of protection it would achieve over a lower preference cleanup action.” The determination of practicability is made using an analysis of cost vs. benefit. The cost/benefit analysis can be performed quantitatively using the overall scoring of the non-cost criteria as the net benefit.

The estimated costs for the alternatives are summarized in Table 10-2. The costs of remediation alternatives are estimated for budgetary and evaluation purposes; the actual cost of the remediation may vary. The cost estimates in this FS are based on the description of the alternatives and associated design assumptions in Section 7. The detailed cost for the evaluated alternatives are provided in Table 10-3. The total yards to be excavated under alternatives 4, 5 and 6 were based on the excavation area identified on Figure 9-2 and an average depth of 5 ft.

The estimates were prepared to allow comparative evaluation of alternatives, not for budgeting purposes. The design basis is subject to change during final, detailed design of the selected alternative, and these changes would affect the cost of the remedy. The cost estimates are suitable for comparative evaluation of the alternatives as discussed in Section 10.5.1.3.

The ratio of net benefit to estimated cost, which is a measure of cost-effectiveness, is given in Table 10-4. On a cost/benefit basis, the alternatives rank as follows:

1. Alternative 4 - Excavation and Off-Site Disposal.
2. Alternative 5 - Excavation and On-Site Treatment.
3. Alternative 6 - Excavation and Off-Site Treatment.
4. Alternative 3 - Capping – Monitoring and Institutional Controls.

10.6 Recommended Alternative

Alternative 4 provides the optimum combination of the permanence criteria and reasonable restoration time frame factors. In addition, this alternative provides the best cost/benefit ratio. Considering the criteria and approach specified in WAC 173-340-360, Alternative 4 is the remediation alternative for the Site that is “permanent to the maximum extent practicable,” and is therefore the recommended alternative for remediation of this site.